DOCUMENT RESUME

ED 120 965 EA 008 128

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TITLE Schooling and Learning.
PUB DATE 76
NOTE 12p.
JOURNAL CIT The Georgia Principal; v12 n2 pp18-28 Win 1976

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage
DESCRIPTORS *Academic Achievement; *Educational Research; Educational Resources; Elementary Secondary Education; *Input Output Analysis; Literature Reviews; School District Spending; *Socioeconomic Background; *Teacher Characteristics

ABSTRACT

Numerous studies have investigated the relationship between educational resources and learning. Many researchers have used the production function form of input-output analysis in an attempt to determine the relationship between certain output indicators (e.g., reading achievement) and certain inputs (e.g., pupil-teacher ratio). Measures of input are often separated into socioeconomic characteristics and school characteristics. Evidence tends to support the contention that the accomplishments of schools are limited by the socioeconomic background of their students. However, the interest of educators centers primarily on school resource variables, since only they can be affected by educational practice and policy. Generally, teacher characteristics appear to be the most important school-related determinants of school output. For example, Brown's study of 183 Georgia school districts indicated that highly productive districts tended to spend more for instruction; since teacher salaries account for most of this budget category, these findings lend credence to the hypothesis that acheivement is probably a function of teacher quality. (Author/JG)

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*Schooling and learning

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Of all the cause and effect relationships existing in education, probably the most vital to the future of public education is the relationship of educational resources or schooling to learning. With the watchdog, "accountability," ever- present, school principals faced with the responsibility of determining a course of action have, perhaps, the greatest need for conclusive research into this relationship. Voluminous studies and reports have approached this linkage in a variety of ways. Still, we do not have sufficient, conclusive evidence to plot a sure fire path to success. Many factors highly associated with learning cannot be changed by educators. For example, family income is frequently associated with achievement, but is beyond the realm of educational control. Of equal or greater concern is the fact that research evidence on the factors that can be changed is frequently conflicting. The purpose of this paper is to examine some of the research into the relationship of schooling to learning, and, hopefully, to suggest realistic and fruitful direction.

Such an undertaking is, at best, formidable. Goodlad (1975), in referring to a systems approach to accountability, indicates that "there is not a science of education sufficient to give credence to the scientism necessarily indicated if any model of accountability . . . is to function effectively" (p. 110). Perhaps Grant (1972) best indicated the state of the art in his review of the published results of the Harvard University Faculty Seminar on the Coleman Report.

> What happens is that conclusions are stated, then modified, hedged, picked apart, doubted, even contradicted in some ways, and, finally restated with more modifiers. The reader must then decide if a bucket with so many holes in it holds water. Often it does not, but the conclusions are stated with a sort of hopeful air, trusting the reader to make some good use of them. The bucket still holds some water, doesn't it? Or, if it doesn't, perhaps there is a way to make use of it as a sieve. (p. 118)

Input-Output Analysis

Of the various approaches to the study of the relationship between schooling and learning, input-output analysis is probably the most frequently used. This form of analysis rests on the assumption that schooling

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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*From The Georgia Principal; v12 n2 Winter 1976

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EA 008 128

is a process where physical, financial, and human resources (inputs) combine and interact to bring about behavioral changes (i.e., learning) in a human product, the student (output). Input-output analyses, in education, like most social science research, rarely determine casual relationships. The nature of the subjects under investigation prohibits the employment of many truly experimental structures. This restriction has generally limited research findings to measures of association rather than cause and effect.

In attempts to determine the relationships between certain output indicators (e.g., reading achievement) and certain inputs (e.g., pupil-teacher ratio), many researchers have used the production function form of input-output analysis. Levin (1970) depicts the educational production function as a "technological relationship showing the maximum amount of educational output that could be produced by each and every set of specified inputs or factors of production" (p. 176). In other words, the educational production function seeks to identify the factors which affect learning and their relative influence on learning. He uses the functional equation:

$$A = f(B, X_1, X_2, \ldots, X_n)$$

Where "A represents a composite measure of educational outcomes (and is a function of the other variables), B represents the various characteristics of the students . . ., (and) the variables X_1, X_2, . . ., X_n represent the inputs . . ." (p. 176). Ideally, A would include such output measures as student performance on standardized achievement tests, positive affective changes, student performance after completion of the educational program as well as the holding power of the school as indicated by dropout rates. Such a comprehensive measure of output is generally not found in most research studies.

Input Measures

Measures of input are often classed into two groups: socioeconomic characteristics and school characteristics. Coleman (1975) reports that the *International Studies in Evaluation* (1973) placed input measures in three blocks. Block 1 contained variables representing home background and included age and sex. Block 2 variables indicated the type of school and the type of program. Block 3 consisted of school and instructional variables, or school resources. In the second block of variables, "the type of program shows primarily the degree of selection of high and low performing students into different schools . . ., when there are differing school types and differing programs, as there were in the (International Studies)" (p. 356). In most U. S. schools, students are not selected to attend a given type of school. Attendance zones serve as the primary selection measure, but not for a specific type of school. Consequently, school and program types are generally not an integral part of most U. S. studies.

Typically, the reason for separating variables into groups or blocks is to facilitate a specific statistical treatment (regression analysis) so as to determine the amount of output (achievement) that can be explained by schooling. By entering non-school variables first into the regression analysis, it is possible to determine their impact on achievement. After such determination, school variables are added to the analysis to determine their additional impact on achievement. If the additional impact of school variables can be determined, the next step is to establish relationships between specific school resources and the amount of the additional impact. For example, if we find that socioeconomic variables explain 50% of the differences in achievement scores and that the addition of certain school resources increases the amount of explained variance to 65%, then we would want to determine which of the specific school resources accounted for the additional explained variance. Further, we would want to know the relative explanatory power of each of the school resources.

Cultural, Societal, and Social Background

Schools are inseparable from the cultural, societal, and social values of the environment in which they exist. Schools partially reflect the society in which they exist and to understand schools implies an understanding of society (Corwin, 1965, p. 156). The fact that we are a reading and writing society partially explains the great concern for the inability of schools to be effective in teaching all students to read and write with a high level of proficiency.

That cultural, societal, and social background of students contributes significantly to achievement is without question. In one of the most extensive studies in the area of school productivity, Coleman and his associates (1966) found that "when (these factors) are statistically controlled . . ., it appears that differences between schools account for only a small fraction of differences in pupil achievement" (p. 22). In fact, Lantos (1971) indicates:

> The most significant conclusion of the Coleman Report which . . . should be the first line of discussion of all issues pertaining to accountability and productivity, is that factors outside the schools are more significant in determining educational outcomes than are factors within the schools. (p. 12)

The importance of factors outside the school led Bowles (1969) to suggest that differentiation among classes of students be an integral part of production technologies. He had found that educational processes and resources generally explain only a small percentage of the variance associated with productivity.

Home Background

We have heard and frequently argue that schools are limited in what

they are able to accomplish because of home background of the students. The evidence certainly tends to support this contention. For example, in a five year study of five thousand American families the Institute for Social Research at the University of Michigan (Morgan, Dickinson, Benue, and Duncan, 1974) concluded that:

> Two children with identical cognitive skills, achievement motivation, parental education levels, and so on, who differ only in that one comes from a family whose average income is $5,000 while the other's family income is $15,000 can be expected to differ in their own educational attainments by about one-half year. (p. 313)

If schools are to continue to be accountable for results as advocates of accountability suggest, it appears that the most defensible posture for educators under the fire of accountability is one of contingency. That is—given certain conditions (i.e., indicators of input characteristics), specified results can realistically be accomplished only within a limited range. It may be that educators have the legitimate right to reject the charge that schools must be successful with all students. Realizing that the industrial analogy is overworked, still we may hazard the comparison that products of steel mills are highly dependent upon the quality of the raw materials. Research provides a great deal of evidence to support a similar position for education. Probably the most conclusive evidence gathered by research into the relationship of schooling and learning is that the cultural, societal, social, and home background of students is the most powerful predictor of their school achievement.

School Resources

The interests of educators center primarily on school resource variables. Such attention is appropriate, because they are the variables that can be changed by educational practice and policy. School resources refers to a large number of variables, including financial, physical and human resources. In addition, educators are also concerned about the manner in which these resources are ordered, assembled, arranged, organized, and made available for the purpose of the school.

Although each school district has a unique mix of resources for learning, there are similarities between districts. Since similar patterns of resource mixes exist, researchers have sought to associate these patterns with production. While it would appear reasonable that certain optimum mixes of resources should be indicated by such associations, this is not necessarily the case. Levin (1970) points out two of the difficulties with this assumption. First, "the educational models underlying these studies are not yet so refined, nor are the techniques of measurement so perfect that we can consider the results as final ones" (p. 190). Second, "no one set of average findings is readily applicable to all student populations under all conditions" (p. 191).

Several studies have investigated the relationship between school

expenditures and achievement. Unfortunately, these studies have not consistently found that increased expenditures result in increased achievement. Ribich (1968) found that achievement levels among 6,300 twelfth grade males who ranked in the lowest twenty percent in socioeconomic status were higher in schools where expenditure per pupil was high. However, he also stated that, "the effect of increased school expenditures on test performance is shown to be strongest at the lower end of the expenditure range" (p. 86). Kiesling (1969) found a negative relationship between per pupil expenditures and achievement among lower socioeconomic status students. He observed, "It seems that high expenditure (per pupil) districts do a poorer job of educating their low background students than low expenditure districts do" (p. 359). Such findings lend credence to the belief that expenditures per pupil represents a threshold type variable. That is, up to some point, increasing expenditures will yield increases in achievement. Once reaching this threshold, the power of increasing expenditures to increase achievement progressively diminishes.

Even when student achievement is related to gross expenditures per pupil, we still do not know the particular inputs which have a positive effect on the pupils' achievement. Breaking down expenditures into constituent parts reveals much of the research to be conflicting. Mollenkopf and Melville (1956) found that achievement increases with a decrease in the pupil-teacher ratio. Kiesling (1969) found in four of the many analyses he ran in New York State that achievement increases with an increase in the pupil-teacher ratio. Some researchers have found that achievement increases are associated with an increase in the number of library books. Others have found this not to be the case. The same kind of ambivalence appears when we examine a number of other school variables.

However, some consistency is found in at least one area. Teacher characteristics appear to be the most important school related determinants of school output. Levin (1970) indicates that teacher salaries are related to teacher quality, because higher salaries increase the number of applicants for teaching positions. Having a large pool from which to select, districts paying higher salaries select better quality teachers (p. 189). Higher achievement has frequently been related to higher teacher salaries (Thomas, 1962; DeRuzzo, 1972; Rose, 1972). The Coleman Report found that teacher's verbal ability related rather consistently to student achievement. Rose (1973), Hanushek (1970), Cage (1973), and others have found that teacher experience is a significant factor in predicting achievement. Daeufer (1972) found that teacher morale related significantly to achievement.

Changes in Behavior

The obvious output sought by schooling is learning. This dependent variable or output measure equates in many studies to student achieve-

ment on standardized tests. The Michigan Department of Education (1970) reports that student achievement as measured by standardized tests has been the most used and is perhaps the best single measure of output. In addition to student achievement on standardized tests, three other categories of output measures are frequently seen in productivity studies: (1) power of the school to prevent the dropping out of students, (2) measurements of students' future intentions or actions, and (3) assessment of student attitudes. The use of these measures relies upon the assumption that they are highly correlated with learning.

Coleman (1975) in re-examining the cross-national *International Studies in Evaluation* data found that "reading achievement is more fully an outgrowth of home influences than are literature and science achievement. Reading achievement is less a function of what takes place at school" (p. 382). The results of his re-analysis indicate that "if other tests, less related to reading were used, school effects would be larger than those estimated in previous studies." Thus, if the power of school effects are subject-specific, by selecting reading as the criterion, studies have "probably underestimated the general effects of the school relative to the home" (p. 382). Because of the lack of available test data on each curriculum area and the relative importance of reading success to success in other academic subjects, reading achievement test scores have been heavily relied upon as an acceptable output measure (Guthrie and Kleindorfer, 1971).

A Georgia Study: Phase One

In a study of 183 of Georgia's 188 school districts (Brown, 1974), nine socioeconomic and community background variables were postulated as predictors of average school district achievement on the verbal part of the Cognitive Abilities Test. Three of the variables proved to be significantly and positively related to verbal achievement: (X_1) percent of students in ADA not receiving free or reduced priced lunches, (X_2) percent of families whose annual income was equal to or exceeded $15,000, and ($X_3$) percent of children under 18 years of age who lived with both parents. These relationships were significant beyond the 0.01 level of chance probability and the three variables combined to explain approximately 49 percent of the variance in achievement.

Table 1 presents the order of entry of the nine background variables into the multivariate prediction function. The broken line represents the point at which no additional significant prediction abilty could be gained by entering the remaining variables into the functon. The significance of variable X_1 (percent of students in ADA who did not receive free or reduced priced lunches) supported the contention of the Georgia Department of Education (1973) in that "Eligibility for free or reduced priced lunches . . . is the most accurate index of socioeconomic status of a school or system that is available." The evidence in this study suggests

TABLE 1

ORDER OF ENTRY OF SOCIOECONOMIC AND COMMUNITY BACKGROUND VARIABLES INTO THE PREDICTION FUNCTION

Variable No.	Variable Title	F-to-Enter	Probability of Chance Occurrence	Multiple R	R^2
X_1	Percent of students in ADA not receiving free or reduced price lunches	128.7467	<.01	.64	.42
X_2	Percent of families whose annual income was equal to or exceeded $15,000	14.3589	<.01	.68	.49
X_3	Percent of children under 18 years of age who lived with both parents	8.9829	<.01	.70	.49
X_4	Median school years completed by adults in the district	1.3300	NS	.70	.49
X_5	Median income of families in the district	0.7685	NS	.70	.49
X_6	Percent of elementary students enrolled in private schools	0.8365	NS	.70	.49
X_7	Percent of families in the district whose annual income was below the minimum subsistence level	0.5628	NS	.70	.49
X_8	District Population	0.1570	NS	.70	.49
X_9	Ratio of non-workers to workers in the district	0.1376	NS	.70	.49

NOTE: NS = Not Significant

again that factors beyond the control of the school have a significant impact upon the output of the school.

A Georgia Study: Phase Two

Since background factors contributed heavily to the explanation of the differences in achievement among districts, an attempt to control their effect was made by comparing groups of districts similar in the percent of students not receiving free or reduced priced lunches, the percent of families whose annual income was equal to or exceeded $15,000, and the percent of persons under 18 years of age who lived with both parents. Using this method, high and low productive groups of districts were formed by predicting average district achievement from these background factors and comparing each district's predicted score with its actual or observed score. Those districts whose observed scores were 4.26 points (1.33 standard errors of estimate) or more above their predicted scores were placed in the high productive group. Those districts whose observed scores were 4.26 points or more below their predicted scores were placed in the low productive group.

Thirteen school related variables were selected as possible predictors of group membership. Only one, the expenditure per pupil for instruction proved to be an efficient significant predictor. Table 2 shows the order of entry of the variables into the function which differentiates between high and low productive group membership. Although district size had a significant entry value after the entry of instructional expenditures, the addition of district size to the prediction function decreased the overall accuracy of classification of districts into high and low productive groups. Therefore, the most efficient function for predicting group membership was determined by expenditure per pupil for instruction alone.

Further analysis of the results indicated that highly productive districts tended to spend more for instruction than those districts which were low in production. However, the instructional expenditures best predicted membership in the low productive group of school districts. This finding tends to support earlier contentions that expenditure levels probably represent a threshold type variable. Specifically, it may indicate that increased availability of instructional resources in low productive districts would result in higher productivity. The expenditure for instruction is a budget category which reflects teacher salaries, supplies and materials, as well as teacher training and experience. Since teacher salaries make up the bulk of this budget category, these findings lend credence to the assertion that achievement is probably a function of teacher quality.

Conclusion

If we group factors relating to educational output (learning) on the basis of their potential for control by educational policy makers, we quickly find that social and economic background factors fit in the un-

TABLE 2

ORDER OF ENTRY OF SCHOOL RESOURCES VARIABLES INTO THE DISCRIMINANT FUNTION

Variable Number	Variable Title	F-to-Enter Value	Level of Signif-icance	Percent Classified Accurately
X_1	Instruction Expenditure per pupil	6.7168	$<.05$	71
X_2	District Size	4.2921	$<.05$	68
X_3	Operations Expenditure per pupil	0.06653	NS	68
X_4	Current Total Expenditure per pupil	0.9619	NS	68
X_5	Average Teacher Salary	1.6896	NS	71
X_6	Local Receipts per pupil	0.8737	NS	79
X_7	State Receipts per pupil	1.4973	NS	79
X_8	Transportation Expenditure per pupil	0.0817	NS	79
X_9	Fixed Charges Expenditure per pupil	0.0884	NS	82
X_{10}	Attendance Expenditure per pupil	0.0810	NS	85
X_{11}	Federal Receipts per pupil	0.0201	NS	79
X_{12}	Maintenance Expenditure per pupil	0.0058	NS	76
X_{13}	Administration Expenditure per pupil	0.0048	NS	82

NOTE: NS = Not Significant

controllable group. The controllable group contains only those factors relating to school resources. Yet, here we face a dilemma, because conclusive evidence about the use of school resources is not in abundant supply. Although we know schools contribute to learning, just where and how is this contribution made?

Even though the literature does not show a consistent and positive relationship, the area which appears to have at least a very good track record is the interface of teacher and student. Teacher characteristics including age, sex, certificatior level, experience, attitudes, values, human relations and communication skills, and others in conjunction with student characteristics deserve a great deal of research consideration.

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